

# Claims

- [c1] 1. A wide viewing angle liquid crystal display, comprising:
- a back light unit;
  - an optical compensation circular polarizer unit set over the back light unit;
  - an optically self-compensated birefringence liquid crystal panel set over the optical compensation circular polarizer unit; and
  - an optical compensation circular analyzer set over the liquid crystal panel.
- [c2] 2. The liquid crystal display of claim 1, wherein the optical compensation circular polarizer unit further comprises:
- a polarizer plate; and
  - a first biaxial compensation film sandwiched between the polarizer plate and the liquid crystal panel.
- [c3] 3. The liquid crystal display of claim 2, wherein the first biaxial compensation film has principal refractive indices  $n_x$ ,  $n_y$  and  $n_z$  that satisfies the following inequality relations:  $n_x > n_y > n_z$  and  $4 > (n_x - n_z) / (n_x - n_y) > 2$ , and the principal axis with the refractive index  $n_x$  forms an in-

cluded angle between  $40^\circ$  to  $75^\circ$  with the alignment direction of the liquid crystal panel.

[c4] 4. The liquid crystal display of claim 2, wherein the optical compensation circular analyzer unit further comprises:

an analyzer plate, wherein the absorption axis of the analyzer plate is perpendicular to the absorption axis of the polarizer plate, and the absorption axis of the polarizer plate forms an included angle between  $40^\circ$  to  $75^\circ$  with the liquid crystal panel;

a uniaxial quarter-wave plate sandwiched between the analyzer plate and the liquid crystal panel, wherein the optical axis of the second uniaxial quarter-wave plate forms an included angle of about  $45^\circ$  with the absorption axis of the analyzer plate; and

a second biaxial compensation film sandwiched between the second uniaxial quarter-wave plate and the liquid crystal panel.

[c5] 5. The liquid crystal display of claim 4, wherein the second biaxial compensation film has principal refractive indices  $n_x'$ ,  $n_y'$  and  $n_z'$  that satisfy the following inequality relations:  $n_x' > n_y' > n_z'$  and  $(n_x' - n_z') / (n_x' - n_y') > 6$ , and the principal axis with the refractive index  $n_x'$  is perpendicular to the alignment direction of the liquid crystal panel.

- [c6] 6. The liquid crystal display of claim 1, wherein the optical compensation circular polarizer unit further comprises:
- a polarizer plate;
  - a first uniaxial quarter-wave plate sandwiched between the polarizer plate and the liquid crystal panel, wherein the optical axis of the first uniaxial quarter-wave plate and an absorption axis of the polarizer plate form an included angle of about  $45^\circ$ ; and
  - a first biaxial compensation film sandwiched between the first uniaxial quarter-wave plate and the liquid crystal panel.
- [c7] 7. The liquid crystal display of claim 6, wherein the first biaxial compensation film has principal refractive indices  $n_x$ ,  $n_y$  and  $n_z$  that satisfy the following inequality relations:  $n_x > n_y > n_z$  and  $(n_x - n_z)/(n_x - n_y) > 6$ , and the principal axis with the refractive index  $n_x$  is perpendicular to the alignment direction of the liquid crystal panel.
- [c8] 8. The liquid crystal display of claim 6, wherein the optical compensation circular analyzer unit further comprises:
- an analyzer plate, wherein the absorption axis of the analyzer plate is perpendicular to the absorption axis of the polarizer plate, and the polarizer plate form an in-

cluded angle of between  $40^{\circ}$  to  $75^{\circ}$  with the alignment direction of the liquid crystal panel; and  
a second biaxial compensation film sandwiched between the analyzer plate and the liquid crystal panel.

[c9] 9. The liquid crystal display of claim 8, wherein the second biaxial compensation film has principal refractive indices  $n_x'$ ,  $n_y'$  and  $n_z'$  that satisfy the following inequality relations:  $n_x' > n_y' > n_z'$  and  $4 > (n_x' - n_z') / (n_x' - n_y') > 2$ , and the principal axis with the refractive index  $n_x'$  forms an included angle of between  $20^{\circ}$  to  $50^{\circ}$  with the alignment direction of the liquid crystal panel.

[c10] 10. The liquid crystal display of claim 6, wherein the optical compensation circular analyzer unit further comprises:

an analyzer plate, wherein the absorption axis of the analyzer plate is perpendicular to the absorption axis of the polarizer plate, and the polarizer plate form an included angle of between  $40^{\circ}$  to  $50^{\circ}$  with the alignment direction of the liquid crystal panel;

a second uniaxial quarter-wave plate sandwiched between the analyzer plate and the liquid crystal panel, wherein the optical axis of the second uniaxial quarter-wave plate forms an included angle of about  $45^{\circ}$  with the absorption axis of the analyzer plate; and  
a second biaxial compensation film sandwiched between

the second uniaxial quarter-wave plate and the liquid crystal panel.

[c11] 11. The liquid crystal display of claim 10, wherein the second biaxial compensation film has principal refractive indices  $n_x'$ ,  $n_y'$  and  $n_z'$  that satisfy the following inequality relations:  $n_x' > n_y' > n_z'$  and  $4 > (n_x' - n_z') / (n_x' - n_y') > 2$ , and the principal axis with the refractive index  $n_x''$  is perpendicular to the alignment direction of the liquid crystal panel.

[c12] 12. A wide viewing angle liquid crystal display, comprising:  
a back light unit;  
an optical compensation circular polarizer unit set over the back light unit;  
a liquid crystal panel set over the optical compensation circular polarizer unit;  
an optical compensation circular analyzer set over the liquid crystal panel;  
a cholesteric liquid crystal layer; and  
a first biaxial compensation film sandwiched between the cholesteric liquid crystal layer and the liquid crystal panel, wherein the first biaxial compensation film has principal refractive indices  $n_x$ ,  $n_y$  and  $n_z$  that satisfy the following inequality relations:  $n_x > n_y > n_z$ , and the principal axis with the refractive index  $n_x$  is perpendicular to

the alignment direction of the liquid crystal panel.

- [c13] 13. The liquid crystal display of claim 12, wherein the optical compensation circular analyzer unit furthermore comprises:
- an analyzer plate, wherein the absorption axis of the analyzer plate is perpendicular to the absorption axis of the polarizer plate, and the polarizer plate forms an included angle of between  $15^{\circ}$  to  $50^{\circ}$  with the alignment direction of the liquid crystal panel;
  - a uniaxial quarter-wave plate sandwiched between the analyzer plate and the liquid crystal panel, wherein the optical axis of the uniaxial quarter-wave plate forms an included angle of about  $45^{\circ}$  with the absorption axis of the analyzer plate; and
  - a second biaxial compensation film sandwiched between the uniaxial quarter-wave plate and the liquid crystal panel, wherein the second biaxial compensation film has principal refractive indices  $n_x'$ ,  $n_y'$  and  $n_z'$  that satisfy the following inequality relations:  $n_x' > n_y' > n_z'$ , and the principal axis with the refractive index  $n_x'$  is perpendicular to the alignment direction of the liquid crystal panel.
- [c14] 14. The liquid crystal display of claim 12, wherein the optical compensation circular analyzer unit furthermore comprises:
- an analyzer plate, wherein the absorption axis of the an-

alyzer plate is perpendicular to the absorption axis of the polarizer plate, and the polarizer plate forms an included angle of between  $15^{\circ}$  to  $50^{\circ}$  with the alignment direction of the liquid crystal panel; and a second biaxial compensation film sandwiched between the analyzer plate and the liquid crystal panel, wherein the second biaxial compensation film has principal refractive indices  $n_{x'}$ ,  $n_{y'}$  and  $n_{z'}$  and the principal axis with the refractive index  $n_{x'}$  forms an included angle of between  $20^{\circ}$  to  $50^{\circ}$  with the alignment direction of the liquid crystal panel.